

REMARKS

In the present amendment, claim 2 has been amended, claims 1, 3-11, and 14 have been canceled, and new claims 21-23 have been added. Accordingly, claims 2, 12, 13, and 15-23 are pending in the application, with claim 2 being independent.

Applicants note that claim 2 has been amended by adding the subject matter of now canceled claim 14.

Support for new claim 21 can be found in the present specification, e.g., at paragraph [0054], lines 5-11, and paragraphs [0097] to [0100] of the published application.

Support for new claims 22 and 23 can be found, e.g., in paragraph [0054], lines 11-14 of the published application.

No new matter has been added.

Rejection under 35 U.S.C. § 103(a)

The Office Action maintains the following claim rejections under 35 U.S.C. § 103(a): claims 1-6, 8-15, and 17-20 as allegedly unpatentable over Noritaka et al. (JP 2000-159850), in view of Mori et al. (WO 2001/51561); and claims 1-20 over Noritaka in view of Mitsuuchi et al. (U.S. Patent No. 5,212,222).

The Office Action repeats the same arguments asserted in the previous rejections. The Office Action further replies to Applicants' arguments provided in the amendment filed on December 28, 2010, stating that "the alleged unexpected results with respect to the amount of formaldehyde generated due to the specific selection of polyacetal and hydrazide" ... "is not found persuasive because the claims are not commensurate in scope with the data provided."

In response, Applicants note that in an attempt to advance prosecution of the present application and without expressing agreement with or acquiescence to the rejections, claim 2 has been amended and claims 1, 3-11, and 14 have been canceled to render the rejections moot.

Applicants point out that the presently claimed polyacetal resin composition employs a) a polyacetal resin having a generation amount of formaldehyde of not more than 100 ppm when heated at a temperature of 200°C for 50 minutes under the nitrogen atmosphere (hereinafter “specific POM”), and b) a hydrazide compound limited to a hydrazide represented by formula (3), (hereinafter “a specific hydrazide compound”). Moreover, amended independent claim 2 recites c) that the specific POM is obtained through a specific heat treatment of unstable terminal groups.

Applicants note that according to the features of the presently claimed invention, unexpected results were obtained with respect to the amount of formaldehyde released from the resin composition or an article thereof, which is remarkably reduced in comparison to values known or expected from commercial polyacetal compositions. Applicants emphasize that the presently claimed polyacetal resin composition releases only an amount of 1 mg/kg or less formaldehyde (see claim 18), measured by method VDA275 defined by the German Association of the Automobile Industry (Verband der Automobilindustrie e.V.: “VDA”), and is also excellent in long-term thermal aging resistance.

Applicants respectfully refer to Tables 1 and 2 below, which demonstrate the advantages and unexpected results of the presently claimed invention.

It can be seen in Table 1 that the amount of formaldehyde emission by using the combination of specific POM and the specific hydrazide compound is in average only 3 to 6% of the formaldehyde emission of resin compounds that do not contain a specific hydrazide

compound. For example, by employing (a-1) as specific POM and a specific hydrazide compound, a formaldehyde emission of only 0.12 mg/kg is measured (see Example 2), but if the same specific POM is employed without containing a specific hydrazide, the formaldehyde emission is 3.5 mg/kg (see Comparative Example 1). Setting the value of 3.5 mg/kg to 100% formaldehyde emission, the value of 0.12 mg/kg corresponds to 3.4% formaldehyde emission. Table 1 further demonstrates that if a specific hydrazide compound is combined with a polyacetal resin other than the specific POM, the formaldehyde emission is about 22 to 23% percent based on the amount of formaldehyde emission if no specific hydrazide compound is employed in the composition (see Comparative Example 4 compared with Comparative Example 3).

Applicants note that a reduction in formaldehyde emission to the range of 22 to 23% (based on the emission without using formaldehyde scavenger) is what would have been expected by one skilled in the art by employing a specific hydrazide. As also pointed out in the previously filed response, the disclosure of Nakagawa (JP H10-298401) demonstrates a reduction of formaldehyde emission from 450 ppm to 110 ppm when a hydrazide is added to the resin composition, which corresponds to a value 24% (based on 450 ppm). Applicants emphasize that a reduction to about ten times lower formaldehyde emission values (22 to 23% vs. 2.4 to 3.5%) if a specific POM is combined with a specific hydrazide would have been highly unexpected to one skilled in the art.

	Comp. Ex. 3	Comp. Ex. 4	Comp. Ex. 1	Ex. 2	Comp. Ex. 2	Ex. 10
Polyacetal Resin	a-3 (POM other than the specific POM)		a-1 (one of the specific POM)		a-2 (one of the specific POM)	
Hydrazide	None	Included	None	Included	None	included
Emission amount of formaldehyde at 200°C [mg/kg]	8.2	1.8	3.5	0.12	4.2	0.23
Emission amount of formaldehyde at 200°C [%], based on formaldehyde emission of the composition not containing the Hydrazide	100	22	100	3.4	100	3.5
Emission amount of formaldehyde at 240°C [mg/kg]	26.5	6.2	13.2	0.32	20.3	0.65
Emission amount of formaldehyde at 240°C [%], based on formaldehyde emission of the composition not containing the Hydrazide	100	23	100	2.4	100	3.2

Table 1

Applicants note that Noritaka does not teach the use of the specific hydrazide compound in combination with the disclosed polyacetal copolymer, as also admitted by the Examiner. With respect to the disclosure of Mori and Mitsuuchi, which allegedly remedy the deficiency of Noritaka by disclosing the possible use of a specific hydrazide compound as formaldehyde scavenger, Applicants respectfully note that there is no indication in Mori or Mitsuuchi that a specific hydrazide compound would have such high efficiency in formaldehyde reduction as unexpectedly discovered by the present invention. Both Mori and Mitsuuchi list examples of a specific hydrazide compounds together with a large variety of other formaldehyde scavengers. Moreover, all working examples in Mori rely on only three formaldehyde scavengers, i.e., ethyl p-aminobenzoate, 4,4-dimethyl-hydantoin and Tris(hydroxymethyl)aminoethane and do not include a specific hydrazide. Similarly, Mitsuuchi does not disclose the use of a specific

hydrazide compound in any of the working examples. Furthermore, Mitsuuchi teaches away from the presently claimed invention by requiring “a stabilization system that employs at least two stabilizers,” wherein the first stabilizer is selected “from among nitrogen-containing compounds and metal-containing compounds, fatty acid ester compounds and metal-containing compounds having a hydroxide moiety, inorganic acid salts or carboxylic acid salts of an alkali metal or an alkaline earth metal,” and the second stabilizer is a hindered phenolic compound (see Mitsuuchi, column 4, lines 12-17, and column 6, lines 22-31). Applicants further note that neither Mori nor Mitsuuchi employs the specific POM of the presently claimed invention. Accordingly, Applicants submit that one skilled in the art would not have been motivated to pick from the large list a specific hydrazide compound for the combination with a specific POM as disclosed in Noritaka. No motivation or indication can be found in Mori and/or Mitsuuchi as to why the combination of specific POM and specific hydrazide compound should be preferred and could lead to the unexpected success in reducing formaldehyde emission.

Applicants further refer to Table 2, which should demonstrate that even if formaldehyde scavengers hydantoin (preferred by Mori) or melanin (preferred by Mitsuuchi) are combined with a specific POM of the presently claimed invention, the resulting resin composition does not show the unexpected results. Applicants point out that the resin composition used for the comparisons in Table 2 is a specific POM disclosed in Comparative Example 8, i.e., TENAC C4520, a product manufactured by Asahi Kasei.

The Office Action states that “since TENAC-C4520 is a comparative polyacetal and not an inventive one,” ... the “Office is unable to concluding anything” from Table 2 and its discussion presented in the previous response (see Office Action, page 7, third paragraph). In response, Applicants emphasize that TENAC-C4520 has been manufactured by a procedure

similarly to the manufacturing of polyacetal resin (a-1) of the present invention. For example, TENAC-C4520 also has been treated with a quaternary ammonium compound as employed in present claim 2. Indication that TENAC-C4520 falls under a specific POM of the presently claimed invention are, for example, its formaldehyde releasing properties: TENAC-C4520 of Comparative Example 8 has a formaldehyde emission of 2.0 mg/kg at 200°C, while specific POM (a-1), which falls under the presently claimed specific POM, has a formaldehyde emission of 3.5 mg/kg (see Comparative Example 1). Similarly, the values of formaldehyde emission at 240°C are comparable between TENAC-C4520 and POM (a-1), being 12.8 mg/kg and 13.2 mg/kg, respectively. In contrast, the amount of formaldehyde released from the resin composition of Comparative Example 3, which employs polyacetal resin (a-3) that not has been treated with a quaternary ammonium compound (and therefore not falling under the presently claimed specific POM), has a much larger formaldehyde emission of 8.2 mg/kg at 200°C and of 12.8 mg/kg at 240°C.

Applicants note that the resin compositions shown in Table 2 were prepared according to the procedure disclosed in Example 1, except for using 100 parts by weight of TENAC-C4520 as the specific POM and 0.1 parts by weight of formaldehyde scavenger. It can be clearly seen that the combination of the specific POM with a specific hydrazide compound leads to unexpected low formaldehyde emissions. In comparison, the combination of the specific POM with hydantoin (hydantoin being one of the preferred formaldehyde scavenger in Mori) cannot achieve such surprising low values. Similarly, the combination of the specific POM and melamine (melamine being one of the preferred formaldehyde scavengers of Mitsuuchi) is not comparable with the low values obtained by using a specific hydrazide compound.

Formaldehyde scavenger		Emission amount of formaldehyde at 240°C (mg/kg)
Hydrazide compound	Sebacic dehydrazide (b-1)	0.6
	Isophthalic dehydrazide (b-2)	0.8
Urea compound	Hydantoin	6.2
Triazine compound	Melamine	4.6

Table 2: Formaldehyde emission of specific POM by variation of the formaldehyde scavenger, measured by VDA275 method

Applicants note that the Examiner has raised concerns that the showing of unexpected results is not commensurate in scope with the claims. In response, Applicants respectfully note that dependent claims are pending that specifically recite features represented in the showing. Applicants respectfully request the Examiner to reconsider the rejection as applied to these dependent claims.

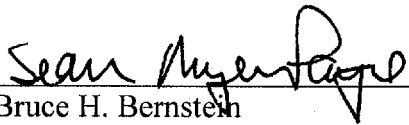
In view of the foregoing amendments and remarks, Applicants respectfully submit that the presently claimed invention is not obvious over Noritaka in view of either Mori or Mitsuuchi, especially in view of the showing of unexpected results. Accordingly withdrawal of the obviousness rejection over Noritaka in view of Mori and of the rejection over Noritaka in view of Mitsuuchi is respectfully requested.

CONCLUSION

In view of the foregoing amendments and remarks, the Examiner is respectfully requested to reconsider the rejections of record, and allow each of the pending claims.

If any issues yet remain which can be resolved by telephone, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,
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